Spring 5-2011

# Parks and Obesity in Rural and Urban Nebraska

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Acknowledgements

Thanks very much to my thesis adviser, Dr. Osborne, for all of the guidance and instruction he gave me throughout this project. Thank you also to my thesis reader, Dr. McQuillan, for helping me understand better ways to approach this study, and for providing me with useful resources and comments.

Abstract

In order to better understand the role community design plays in obesity rates, this project studies a potential relationship between distance of parks from homes and obesity rates in four Nebraska counties. Park use may contribute to important health benefits, such as reducing risk of obesity by increasing physical activity levels. There are limitations to park use, such as crime rates and facility upkeep that are important to understand so that they might be managed and communities can reap greater benefits from their parks, including better fitness. This study examines park distance from homes as a potential limiting factor to park usability. The Nebraska Counties of Adams, Douglas, Lancaster and Lincoln are the subjects of this study. It is predicted that the distance between parks and homes will be greatest in rural counties of Adams and Lincoln and that obesity will be highest there too. An index of parks was created for each county then the distance between each park and the four nearest homes was measured. This information was analyzed and compared with obesity rates of these counties. Obesity and demographic information were obtained from resources of county health departments, the Center for Disease Control's (CDC) Behvioral Risk Factor Survelliance System (BRFSS) (2010), the Census Bureau (2011), Healthy Americans (2011) and the UNMC Rural Health Works (2009) research branch. According to Selected Metropolitan/ Micropolitan Area Risk Trends (SMART), the percentage of obese residents in Adams, Douglas, Lancaster and Lincoln counties are: 30.5, 26.6, 24.4 and 29, respectively. Parks were on average further from homes in rural counties, but the only significant difference in distance was with Lincoln County, where parks were on average more than a mile further from homes than was recorded in any other county. On average, parks in Douglas

County are the closest to homes and parks in Lincoln County are the furthest from homes. Lincoln County reported the worst general health status and the second highest obesity rate. Lancaster County reported the lowest obesity rate and best health status. Parks have high social value and can increase physical activity levels which promote health and deter obesity. A feature of park usability is distance. This study did not support the hypothesis that the most obese county would have parks furthest from homes. It did support the hypothesis that rural counties would have greater distances between parks and homes and higher obesity rates. Obesity is a multifaceted issue and this study suggests one way to approach it is by examining availability of parks, however many social and economic issues must be considered when researching obesity and parks, as both are deeply integrated into social and economic life.

## Introduction

Obesity is a national health problem indicated by dramatic increases since 1980. In 2010 the CDC (2010) reported that twelve states had obesity rates higher than 30 percent. In Nebraska, 64.6 percent of residents are currently overweight or obese (CDC, 2011).Obesity is an issue that is social, biological, medical, economic, cultural and political (Wyatt et al, 2006). Because of this complexity it is important to explore many influences on obesity rates. There are many cultural factors that influence obesity rates including differences among cultural cuisine and beliefs about overweight and health. There has been much interest in individual level factors (e.g. gender, race/ethnicity, behaviors), but more recent research has focus on broader social factors. Environmental factors, such as food accessibility, available modes of transportation, forms of recreation and types of labor, can influence obesity by shaping how individuals behave in their

environments. Research on the influence of physical space on health and obesity is expanding. Some are approaching the issue from using the idea of safe spaces (Farley et al, 2007) while others approach the issue in terms of urban planning and development (Ewing et al, 2003). This study looks at the distance from parks to homes, considering it as a possible proxy for physical activity.

As obesity looms a factor in the lives of many Americans, the need to understand societal factors that can be altered to reduce rates of obesity becomes even more important. This study therefore explores the potential relationship between county economic resources, park accessibility and obesity rates in the Nebraska Counties of Adams, Douglas, Lancaster and Lincoln. It is expected that the county with the greatest distance between parks and homes will be the most obese county. It is also expected that distances between parks and homes will be greater in rural counties.

Because availability of spaces where people can safely engage in physical activity should increase exercise, it is expected that easily usable parks and higher economic resources will help explain differences in rates of obesity between counties. Distance to parks is a focus of this study because distance is a feature of usability and can be a barrier to residents. Moore et al (2010) researched socioecological barriers and facilitators of physical activity in rural and urban youth. Both rural and urban respondents cited distance from facilities (park, community center, etc) as barriers to physical activity and rural residents associated this barrier with cost.

Because rural areas have less dense populations and often have fewer economic resources, it is hypothesized that the distance between parks and homes will be greatest in rural counties and that therefore obesity rates will be highest there too. Greater economic

resources are expected to indicate less social deprivation, greater park usability and better health. Fewer economic resources are expected to indicate greater social deprivation, declined park usability and worse health.

Using the idea that community design, particularly park space, influences health, this project investigates a possible connection between park space and obesity rates. Public parks are used to explore barriers to use and potential relationships with obesity rates. The distances between public parks and homes in Adams, Douglas, Lancaster and Lincoln counties are analyzed. Distance and number of parks within counties are explored to see how distance is a limit to park usability, what other limitations to park use are and if this may be related to obesity rates within these counties.

If park space has a positive influence on health status, then it is expected that those in communities with the most accessible parks should experience slightly lower obesity rates than communities with less accessible parks as a result of increased physical activity. The Trust for America's Health report "F as in Fat" cites some reasons for obesity influenced by community design to be "limited park and recreation space and poor upkeep and security in local parks " (2011, p.101) For a park to be usable involves a combination of physical and social requirements. Physical factors include maintained facilities, such as working street -lights and basketball hoops with nets. Other factors include crime rates of the area and obstacles like interstate or main road location. This study also examines structural and cultural factors of obesity including rural- urban health disparities.

Americans should be concerned with the issue of obesity because it is a major public health concern associated with quality of life. Currently one in three Americans

between the ages of 17 and 24 years are too heavy to be considered for military service (Trust for America's Health, 2011). People not only change the quality and length of their individual lives, but communities are also less able to perform necessary functions and even protect themselves when the bulk of residents are not fit to do so. According to the CDC (2011) nearly one third of firefighters are obese while many more are overweight. Further, it is believed that the rise in heart attacks among fire fighters appears to be correlated with their rising rates of obesity and overweight. There are many positive attributes to being fit and one that is often overlooked is basic safety when responding physical challenges.

Aside from physical health, obesity is an economic concern. Obese employees have higher rates of absenteeism than their non-obese co- workers (Finklestein et al, 2005). Costs of obesity also strain the national economy, as a recent study found direct and indirect costs of obesity to reach up to $147 billion annually (CDC, 2010). The consequences of obesity are great as they reach outside the realm of personal health and involve things like job performance and life span.

Obesity and overweight often lead to other health consequences later in life or premature death. Two significant health consequences are increased risk for cardiovascular disease and diabetes. According to Ali and Crowther (2005, p.1), obesity is associated with health risks beyond those including, "hypertension, cancer, gallstones, respiratory system problems, and sleep apnea". Disability is also cited as another common consequence of obesity. The American Heart Association reports that children who are obese have arteries like those of a 45- year old person. This greatly increases their risk of heart disease. Obesity is a complex health problem impacting the viability of

communities, and the very structure of these communities is now being researched as a potential contributor to health outcomes and obesity rates. This study focuses in particular on the proximity of parks to homes in order to determine if there is a correlation between park distance and obesity rates.

Frederick Law Olmstead, an early park advocate, stated that parks played an especially important role in human life for two main reasons. These were the immersion into nature and easily accessible opportunity for exercise they offered park goers (Garvin 2011). Immersion into nature has benefits for the self beyond exercise. Hartig (2007) describes the restoration to a persons' mental health often given by nature (Hartig, 2007). Dualism between the mind and body is a false dichotomy thus it is important to be in good health in both respects. It is important that spaces that promote such opportunities are available to people. Parks provide social and individual benefits for people. They also can act as a preventive community health measure by increasing physical activity. But while this is true in some neighborhoods, it is also true that in other neighborhoods parks carry greater risk and may discourage use due to crime.

Olmstead was not the only one to recognize the benefits to health parks provided. In the late 1800s, as urbanization was rapidly transforming American life, many park advocates came to voice their belief that parks promote exercise and therefore help people avoid disease (Garvin, 2011). Parks are an important public space for promoting physical activity. Physical activity is something whose value is neglected by contemporary US culture.

People acknowledge how physical environments influence health in blatant examples like Love Canal, NY where contamination by a chemical and plastics industry

was causing a dramatic decline in resident health, but also how the general physical environment is being considered as a factor in health outcomes. Many initiatives to make cities healthier places to live are springing up internationally like the Healthy Cities Project of the World Health Organization (WHO, 1999). The aim of the Healthy Cities project is to, "improve the health of city dwellers through improved living conditions and better health services in association with various urban development activities" (WHO, 1999). Goals are set in cities and responsive to the specific concerns of the area.

There are also specific integrative strategies being applied in communities like Louisville, KY that aim to " increase physical activity and health awareness" (Walfoort, et al, 2009, p.1) in the community by incorporating elements thought to promote active lifestyles such as sidewalks, community centers, pocket parks and a number of activities designed to promote physical activity and community involvement. More local versions are being implemented in places like Lincoln and Omaha, NE by the health department and parks and recreation programs. Some examples of this include the increase of billboards encouraging people to eat healthier foods and exercise.

Garvin (2011) points out that between the 1880s and 1950s there was a large decline in disease, increase in life expectancy and increase in park space. It is hard to say, however, that parks are the most important factor in this trend. This time period marks a significant chapter in US history. The industrial revolution brought great social change. People experienced greater material abundance and food also became easier to secure for the majority of people, resulting in better nutrition. This improvement brought about visible change as white males born in 1980 were found to be, " 2 inches taller than white males born in 1845" (Pope, 2009, p.72). A variety of influences increased life

expectancy, and one not typically coupled with this increase in health is increase in park space.

A new body of research is opening up however and exploring how community design impacts lives of community members. Simon Bell and Alicia Montarzino describe "Physical environments provide a setting for social life"(Bell, Montarzino, 2007, p.57). Health is one aspect of social life impacted by the physical environment. Kipke et al (2007) explore the potential influences of parks on the community level-risk of obesity in young people (Kipke et al, 2007). This is an innovative approach that addresses structural factors associated with health problems, like obesity. Kipke et al point out that, "From an ecological perspective, individual-level behaviors are affected not only by personal characteristics but by interactions with the larger social, cultural and environmental contexts in which children live"( p. 325). Kipke et al also cite that "income inequity and neighborhood deprivation is strongly associated with obesity"(p.326). Income inequity is very important when considering issues of safe play spaces and obesity alike.

Neighborhood deprivation and crime rates are potentially important contributors to park use and physical activity levels. Sallis & Glanz (2006) encourage policy that promotes access to safe place to be active, walkable neighborhoods and healthy foods as it is seen to promote good health behavior and potentially deter obesity. Similarly, Farley et al (2007) analyzed the effect of physical activity after providing a safe play space to inner city school children. Their results were positive, as they found physical activity was 84% higher with the safe space area than in the surrounding neighborhood and concluded that safe spaces increase physical activity. These studies provide crucial insight to the

interconnectedness of all communities and the need for safe play spaces as a health issue and deterrent to obesity.

Parks as a concept of open, usable space is an idea directly involved with this research of community design. Studies like that of Nielsen and Hansen (2007) explore the possible connection between health and green space. Here, the authors report "studies have documented positive health effects of green areas on human health" (p.850). Marcus-Cooper (1999) explains a benefit of gardens is that they promote physical activity and, "Exercise is associated with a variety of physical and psychological (i.e. stress-reduction) benefits, including improved levels of cardio-vascular health, and reduced levels of depression among adults and children"(p.64). Anderson (2011) explains gardening reduces cancer risk in non smokers by 50%. He explains a variety of benefits gardening provides via physical activity, contact with the physical environment and fruits of this environment. The relationship between volume of green space and good health was found to be positive and especially strong among those who spent the most time at home, the elderly, those of low socioeconomic status, and homemakers (Nielsen, Hansen, 2007). Nielsen and Hansen associate volume of green space with mental stress experienced by individuals. This work is important for this study because results "suggest that there is a geography to overweight"(p.63). Bell and Montrazino (2007) state that physical environment has a significant role to play in everyday life but this role is "rarely explicit unless a feature of the environment obstructs, prevents or otherwise interferes with a persons' objectives. This project assesses features of the physical environment and their potential influence on physical activity levels, as well as looking as other factors that shape how people interact with their physical environments.

The complexity of obesity is not limited to these physical environments, however. The ways in which obesity is influenced by genetics is a complex issue attracting much attention from researchers. Prader- Willi Syndrome is a genetic mutation of the 15th chromosome that results in an insatiable appetite and very low metabolism in afflicted individuals. It is estimated to exist in the population at a level of 1 in 15,000 (PWSA, 2011) and it is one of the few known genetic factors to directly cause obesity, although other genes and gene combinations are being discovered for increasing susceptibility of obesity. The FTO gene is one that puts individuals at greater risk of Type II diabetes and obesity (Frayling et al., 2007). This risk increases because the FTO gene is associated with higher body mass indices (BMIs). According to Frayling et al, those homozygous for the "risk allele weighed about 3 kilograms more and had 1.67 fold increased odds of obesity" (Frayling et al, 2007, p.889). Genetic components of obesity are being studied and understood more fully by researchers.

Other factors play either a polygenic or monogenic role in obesity. Vaisse describes that, "The genes implicated in these forms of obesity encode proteins of the leptin axis and brain-expressed targets of leptin involved in the melanocortin pathway" (Vaisse et al, 2000, p.254). The melanocortin 4 receptor responds to the signal of a hormone expressed in the hypothalamus and is important in terms of weight regulation. Vaisse goes on to say, "mutations in MC4-R are the most frequent genetic cause of common obesity described to date" (Vaisse et al, 2000, p.262). They found mutations of the melanocortin 4 receptor to be associated with morbid obesity, but allow that these mutations do not always lead to obesity and described a range of heterozygous carriers and differing energy environments. Genetic influences are important to consider as it is a

reminder that although physical activity is used by many to maintain or increase physical fitness and thus prevent obesity, there are sometimes other factors at play that make fitness harder to obtain despite behavior.

Epigenetics also play a role in obesity. Yajnik and Deshmukh (2008) studied children who had low birth weights and the high weights at age eight. Indicators they used to measure risks included glucose levels, insulin resistance, lipids, leptin levels and blood pressure. Leptin is a gene that produces a hormone that regulates appetite and is linked with obesity. Much recent research examines the role this hormone has in obesity. Serotin pathways have been noted for playing a significant role in bone mass accrual, appetite, and energy expenditure. Yadav et al discuss, "leptin regulation of these functions occurs by inhibiting serotonin synthesis in neurons of the brainstem" (Yadav et al, 2009,p.41). Leptin effects serotonin synthesis, which impacts appetite and energy expenditure.

Different inherited suceptibilites to obesity Waterland and Jirtle (2003) describe how early nutrition effects adult phenotype through DNA methylation. Dietary supplements like folic acid "may have unintended influences on the establishment of epigenetic gene regulatory mechanisms during human embryonic development" and these may produce offspring with higher susceptibility to chronic disease.

Another instance of prenatal diet impacting epigenetics is evidenced by the cohort studies of the Dutch Winter Famine. It is established that there is a critical period of development during which maternal diet can influence child weight. Ravelli et al (1976) find that babies exposed to famine during this critical period of early pregnancy exhibited higher obesity rates than those exposed during late pregnancy or during early infancy.

This supports their predictions that," nutritional deprivation affected the differentiation of hypothalamic centers regulating food intake and growth, and that subsequent increased food availability produced an accumulation of excess fat in an organism growing to its predetermined maximum size" (Ravelli et al, 1976, p.94). These epigenetic changes present themselves in current intrauterine nutrient poor environments. Despite the fact that in some situations, the mother may be consuming enough, or even too many calories, if they are from nutrient poor sources it will send a signal to the baby that the environment is scarce and the baby's metabolism will adjust accordingly. Wells explains, "The thrifty phenotype hypothesis proposed that early-life metabolic adaptations promote survival, with the developing organism responding to cues of environmental quality by selecting an appropriate trajectory of growth" (Wells, 2007, p.143). This selected growth trajectory can manifest itself throughout the life course, in this case, by placing individuals at higher risk of obesity.

Since mutations of certain genes result in syndromes like Prader-Willi Syndrome, it is evident that part of appetite and behavior are genetically controlled. The 'thrifty metabolism' theory evidences that evolution in an energy scarce environment contributes to the obesity rates exhibited in the current energy dense environment. Energy dense foods are highly palatable. Development in a relatively food scarce environment led to animals who eat their fill when food is available to carry them through leaner times. Bellisari explains, "As mammals and primates, humans have the capacity to store body fat when opportunities to consume excess energy arise. But during the millions of years of human evolution such opportunities were rare and transient"(Bellisari, 2008, p.165). However there is an environmental mismatch today as food is readily available and

overfeeding is typical. This is an evolved life strategy that is no longer adaptive in our current environment. Many social and economic factors that potentially interact with diet and physical activity levels are being considered as contributors to obesity.

Obesity is related to individual and community socioeconomic status because it is a factor of food environments on a personal and communal level. The state with the highest poverty rate, Mississippi, is the most obese. Further, "Six of the states with the highest poverty rates are also in the top 10 for obesity" (CDC 2011). Drewnowski and Specter (2004) explain that rates of type 2 diabetes and obesity follow a socioeconomic gradient such that," people with limited resources, racial-ethnic minorities, and the poor" bear the obesity burden at disproportionately high rates (p.6). The least expensive food is viewed as the most available, especially to those with limited resources to spend on food. Drewnowski and Specter write, "obesity promoting foods are simply those that offer the most dietary energy at the lowest cost" (p.9). The least expensive foods are also commonly unhealthy ones, energy dense and nutrient poor. Since 1985 the prices of healthy foods like produce, fish and dairy have increased dramatically in comparison to more energy dense foods like sweets, soda and oils. (Finklestein et al, 2005). People spend money buying inexpensive foods that will fill them up quickly, like McDonalds or Doritos, and skip out on the typically cost prohibitive foods that contain greater nutritional value.

Education level and socioeconomic status are linked and so education level and obesity are also linked. Obesity rates and education level are inversely related. Thirty-two point eight percent of individuals who did not finish high school are obese while 21.5% of individuals who graduated college are obese (CDC 2011). Education level is typically

indicative of income level. People with less education also are typically of lower socioeconomic status and then are more likely to be obese. Food deserts, or areas marked by high fruit and vegetable price, socio-economic deprivation and a lack of locally available supermarkets (Pearson et. al. 2005). Another possible influence could be the type of social environment one is in when attending school due to resources and information one receives in school about diet, nutrition and exercise through programs such as health classes and physical education classes.

Race and ethnicity are also associated with obesity. Minority groups have higher poverty rates and obesity rates than whites. There are also cultural differences influencing obesity rates between groups. For example, wealthy Mexican school children are highly susceptible to obesity as food is given as a reward and viewed as a mark of good parenting. Being heavier is perceived as being healthy (Brewis, 2003). Obesity rates in Nebraska are lower among White men (29.2%) than among Black men (39.7%) and Hispanic men (32%) (CDC, 2011). These numbers reflect not only obesity rates among different ethnicities, but also economic disparity existing between these ethnic groups. A 2008 survey by the Office of Minority Health and Health Equity stated that, "About 30 percent of Nebraska Blacks or African Americans were living below the poverty level " this rate compared with only 9 percent of non-Hispanic whites. (Office of Minority Health and Health Equity, 2008, p.3). The median income of Nebraskans also shows great disparities by race/ethnicity. Whites report a median income level is $47,062, Hispanics report a median income of $46,525 and Blacks alone report $28,423. These statistics suggest that race/ethnicity and socioeconomic status contribute to in obesity risk experienced by individuals. Because groups defined by socioeconomic status and/or

race/ethnicity tend to live in close subgroups in the United States, communities with more Black, Hispanic, and or lower socioeconomic status individuals should have higher obesity. In addition to food access and cultural meanings of food, if lower socioeconomic status communities also have less access to parks, parks should further explain differences in obesity rates between communities.

There are rural-urban disparities in health and this extends to obesity. Rural populations are also typically older and age is positively associated with obesity, especially for women (Trust for America's Health, 2011, p 102). Bell and Montrazino (2007) described rural landscapes as having "as much social deprivation as there is beauty," and went on to say that many prefer to stay if services are available. Lack of public services was noted as a, "major obstacle to living in the countryside" (Bell and Montrazino, 2007, p.58). Public services include parks. This same deprivation is an obstacle of living in rural parts of the United States, and more specifically, Nebraska. According to the Agency for Healthcare Research and Quality (AHRQ 2004), "although 20 percent of Americans live in rural areas only 9 percent of the Nation's physicians practice there" (AHRQ, 2004). Rural areas are typically under greater economic stress than urban areas and this contributes to the obesity rates in rural settings. However, Hendee (1969) argues that recreation follows the opportunity theory. Space and population density both influence opportunities for recreation and there are differences in the forms of recreation pursued as a result of this. The recreation needs of rural and urban places could depend on the nature of the area and whether people practice physical activity in a social setting or a more isolated one.

Physical activity and nutrition influence obesity rates. The state with the highest

level of adult physical inactivity, Mississippi, is also the most obese state (CDC, 2011). At a symposium on obesity, George Blackburn talked about reversing the 'energy gap', which, "refers to an excess of kilocalories consumed per day in combination with a decrease in kilocalories expended, a situation that is responsible for the collective weight gain of the American population over the past several decades."(Ware, 2010, p.5). This change in American culture manifests itself beyond the bathroom scale. On average Americans take fewer than half the amount of steps recommended per day by the World Health Organization (CDC, 2011). People generally work less physical jobs that require them to spend most of their time sitting. Philipson (2001) discusses that," most work entails little exercise" in the post-industrial United States and many people feel the need to pay to engage in exercise, by belonging to a gym or joining a sporting team (p.2). Forms of recreation are increasingly passive as watching TV and computer videos are activities to which people devote a great amount of time. Computer games take away time from games that involve greater physical activity. Being physically active is less a part of daily life than in times past Young people living in neighborhoods with wide access to parks, fields, trails and other green spaces were less likely to be overweight than their counterparts in less green areas. (Trust for America's Health, 2011) Twenty-seven percent of adults in Nebraska (CDC 2011) are physically inactive, this is important to consider when analyzing the social role of parks. Changes in how spare time is used changes individual physicality.

The United States Health and Humans Services (USHHS) reports that 300,000 people die each year, "from health conditions related to diet and inactive lifestyle" (USHHS, 2011). Physical activity prevents a range of chronic diseases. Incorporating

small amounts of physical activity into daily life will improve physical fitness but is often neglected. Further, recreation has changed with culture. Not only have work and school come to involve more time looking at a screen and less time moving, but so has free time. People use social networking websites, video games, movies and television to spend their free time more which allows that less time is spent at the park using ones' body. It is true that there has been a recent focus on games requiring people to "play" or engage in physical activities. As of yet, people have to do a lot of playing before the general population is considered fit. Parks are not only beneficial for the health benefits they provide, they provide social benefits and personal benefits as well, like a place to nurture creativity or relax. Because of the importance of physical activity to fitness and obesity prevention, this study explores park distance from homes as a potential contributor to obesity rates.

## Materials and Methods

Obesity and park data were analyzed with demographic information of four counties in Nebraska. The counties researched in this study are Adams, Douglas, Lancaster and Lincoln. Adams and Lincoln Counties are considered rural, as they both contain microploitan communities only. These counties were analyzed to see if trends are consistent with other research, like that of the Agency for Healthcare Research and Quality, the Trust for America's Health and the UNMC Rural Health Works, has found rural counties to be more economically deprived, which lends them to also seeing social deprivation, such as fewer parks, and experiencing greater health problems. Results of this research may encourage study of a larger sample of communities. Lancaster and Douglas counties are considered urban, as they contain metropolitan areas. Micropolitan

areas are defined as those having an "urban cluster" with between 10,000 and 50,000 people while metropolitan areas contain an urban cluster with a population exceeding 50,000 people. Obesity and demographic information was obtained from resources of county health departments, the Center for Disease Control's (CDC) Behvioral Risk Factor Surveliance System (BRFSS) (2010), the Census Bureau (2011), Healthy Americans (2011) and the UNMC Rural Health Works (2009) research branch.

BRFSS is a branch of the CDC that was developed in 1984. It operates by collecting an extensive volume of information from phone interviews. The aim of this branch is to gather information on, "health risk behaviors, preventative health practices, and health care access." Within the BRFSS, Selected Metropolitan/Micropolitan Area Risk Trends (SMART) analyzes data collected through BRFSS of specific areas. Obesity rates, level of safety perceived and general health status information data were collected using this service. An obesity rate was provided for the micropolitan or metropolitian area of each specific county and one was also provided for the county as a whole. The rate for the entire county was used in the data analysis for this study.

After finding obesity rates for each of the 4 counties of interest, an index of parks was compiled per county. This information was gathered from the Nebraska Game and Parks, Lincoln, Omaha, Hastings and North Platte park services, a state gazetteer and a realty website (hometownlocator.com). Using these indices and Google Earth, each park was located. Google Earth is a program that allows users to see and mark different places on map and also measure distances between points using the measurement tool (Figure 1). The distance between each park and the four homes nearest to it were recorded. The home nearest was typically measured first. Then the next nearest home in each of the

other directions, North, South, East or West, was recorded. Measurements were recorded in miles. An average of the four measures were taken and from these values, an overall average was taken to show the typical distance between a park and home in a particular county.

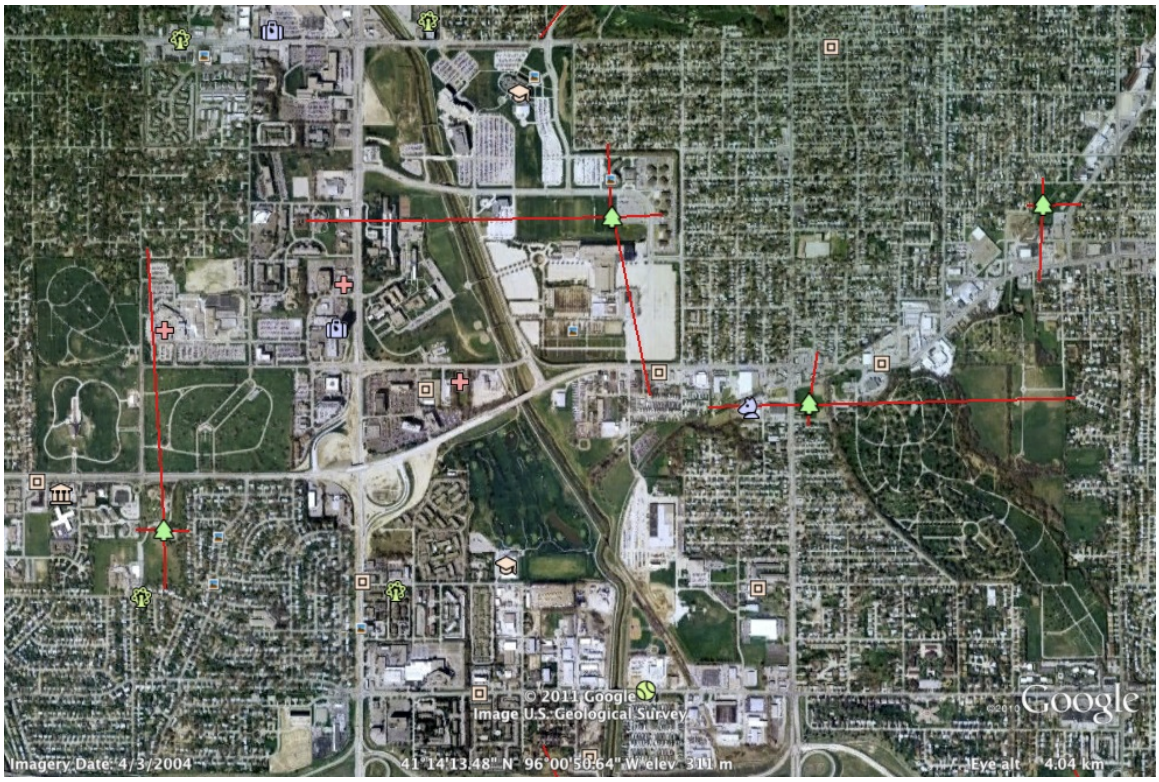


Figure 1 Google Map Image with Park to Home Measurements

Counties were coded: Douglas – 0, Adams- 1, Lancaster-2, and Lincoln -3. The number of parks within defined distances from homes was then quantified. The ranges specified are: 0- .049, .05-.09, .1-.49, .5 -.99, and 1 or greater miles. This data provided the percentages of parks within a certain distance of homes by county. These distances were chosen as they represent the typical range of distances that parks were from homes. The percentage of parks within these discrete ranges is significant because, in contrast to

number of parks per county, these percentages describe how far most parks in that county are from homes. They create a county profile for distances between parks and homes.

Homes were often easier to identify in more urban areas where they were situated among other homes than in rural areas, where they were sometimes more difficult to identify. To verify that the structures were residences, driveways, garages, vehicles, gardens and shelterbelts were considered indicative that the structure was a home and not a large storage unit, business, or another type of building.

Another obstacle to note is that it often seemed there were homes near in three directions but the fourth home was a much greater distance from the park. Initially, measurements were being excluded as outliers if they were a much greater distance from the park than the other homes. However, they were later included because this trend seemed to be more frequent than expected and an important part of normal variation in demographics surrounding parks. Some parks may appear further from homes than they actually are because, for example, although surrounded by neighborhoods on three sides, as is the case with Pershing Park (Douglas County) and Roxbury Park (Douglas County), an industrial park on the fourth side creates a large distance between the park and the next set of houses. This was sometimes true in rural areas as well, except the home was typically distanced by agricultural land rather than an industrial area.

To correct for this, a sample was taken from the index of parks for each county. Sample parks were randomly selected. From this sample, the number of homes within a square mile of each park was quantified. This information was gathered to describe the concentration of homes around parks, in hopes of giving greater depth to park usability data. A sample of 50% was taken of the rural counties, Adams (10 parks) and Lincoln

(11 parks). A sample of 25% was taken of the urban counties, Douglas (40 parks) and Lancaster (27 parks).

Summary statistics were produced for the distances of homes from parks and number of homes within a square mile of parks for all counties and included the mean, median, standard deviation, and range. All pairwise comparisons were made using the Mann-Whitney U Test. When more than two groups were being compared Kruskal-Wallis was used to test for significant differences. Experiment-wise alpha level was maintained at 0.05. All statistics were computed using SPSS (v.19).

## Results

According to SMART, the percentage of obese residents in Adams, Douglas, Lancaster and Lincoln counties are: 30.5, 26.6, 24.4 and 29, respectively (Figure 2).

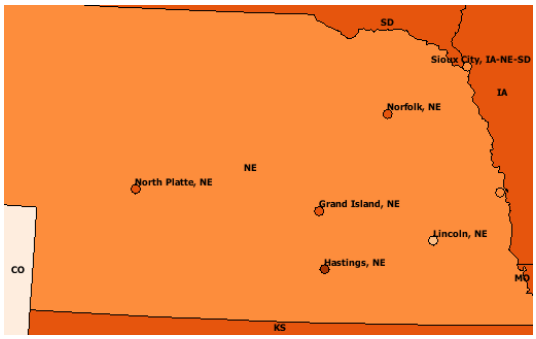


Figure 2, Percent of Obese Nebraskans

| | |
|---|---|
| | <= 22.8 |
| | 22.9 -25.6 |
| | 25.7-28.1 |
| | 28.2-30.6 |
| | > 30.7 |
| | No data |

The counties chosen for this project are all from the state of Nebraska. Adams County is in south- east Nebraska and has a population estimate of 33,238 people (2005-2009 American Community Survey census). Adams County is 563.41 square miles. This

makes 22.3 people per square mile (Adams County Economic Profile). The micropolitan center of this rural county is the county seat of Hastings, Nebraska. The portion of the population over age 65 is 15.6 %. This is 1.7 % higher than the portion of people aged over 65 years in the state of Nebraska. Adams County is most obese with an obesity rate of 30.5%. According to SMART data, 86.5 % of residents report good to better health while 13.5 % report fair to poor health.

Adams County is 95 % white, 6% Hispanic, and .8% African American/ Black. Ninety percent of Adams County residents graduate high school and 22% go on to get their Bachelor's Degree. This gives Adams County the lowest education level of all counties observed. The crime arrest rate in Adams County stands at 46.5 people per every thousand people. This is lower than the state average of 54.2 people per every thousand people. The income level of Adams County is the lowest of all counties considered. Thirty-three percent of residents make less than $30,000 per year and 23% of residents make between $30,000 and $49,000 per year. Seven percent of people make between $100,000 and $149,000 per year. The number of people living below the poverty line in Adams County was recorded at 13.2 % in the 2010 Census.

Twenty parks were recorded and analyzed in Adams County. The average distance between any park and home in Adams County is .3029 miles. This is the second furthest distance of all counties analyzed. Adams County has .037 parks by square mile, this is also the second fewest by square mile. Adams County has the second most parks per capita, coming after Lincoln County, with .0006 parks per capita.

No parks are between 0 and .049 miles from homes and 25% of parks are between .05 and .09 miles from homes (See Figure 3). Sixty-five percent of parks are between .1

and .49 miles from homes, 5% are between .5 and .99 miles from homes and 5% are a mile from homes in Adams County. A sample was taken to assess the number of homes in an area around the park. From this sample, Adams County had an average of 221 homes in a square mile around a park.

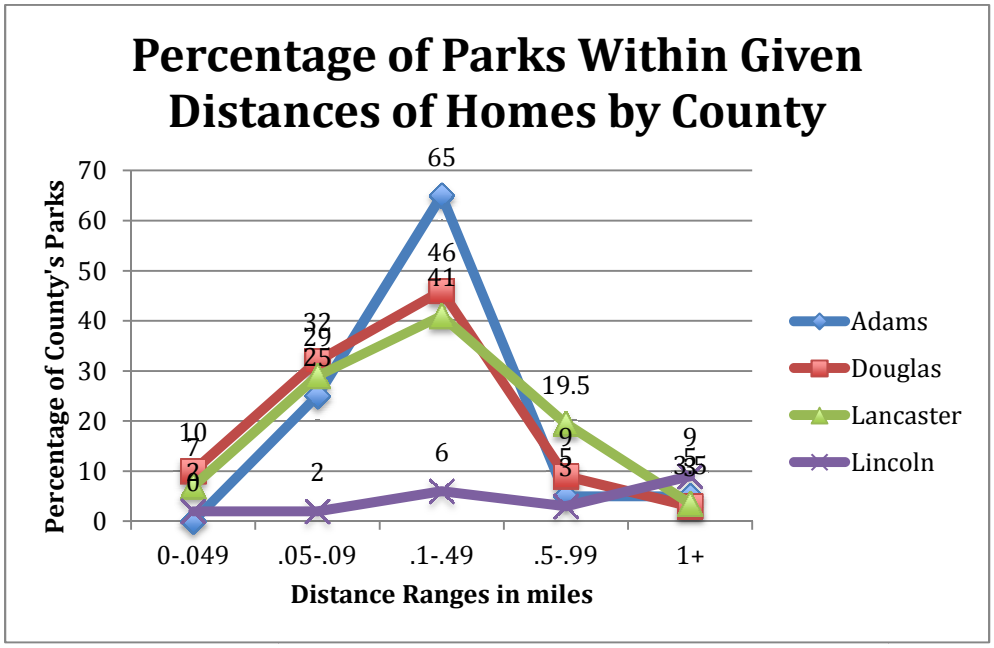


Figure 3, Amount of Parks Certain Distances from Homes by County

Douglas County has the largest metropolitan area. The population estimate is greatest in Douglas County with 497,939 people and the geographical area is the least with 330.98 square miles. This creates a population density of 1400.6 people per square mile. In Douglas County, 13.9% of people are over 65 years.

Douglas County is the most racially or ethnically diverse out of all counties measured. Eighty- three point seven percent of people are White, 9.2 % are Hispanic and 11.8 % are Black. The income levels of Douglas County are highest of all counties

observed. Twenty-nine % of residents earn less than $30,000 per year but 11% earn between $100,000 and 149,999 each year. 40% of people earn between $30,000 and 74,999. And 12% earn between 75,000 and 100,000 a year. Twelve point eight percent of residents live below the poverty line in Douglas County, according to the latest census information. The crime arrest rate in Douglas County is higher than the state average with 64.1 arrests made per thousand people.

Douglas County has the most parks and the least geographical area; however it still has the fewest parks per capita with .00032 parks per person. One hundred and fifty-eight parks were counted and measured in Douglas County. Douglas County has the most parks by area with .48 parks per square mile. The average distance between parks and homes in Douglas County is least with .2299 miles being the average distance. Douglas County had the higher obesity rate of the urban counties with an obesity rate of 26.6%. Eighty-six point two percent of residents reported good to better health status while 13.8% reported fair to poor health.

Ten percent of parks are between 0 and .049 miles from homes and 32% of parks are between .05 and .09 miles from homes (Figure 3). Forty- six percent of parks are between .1 and .49 miles from homes, 9% are between .5 and .99 miles from homes and 3% of parks are a mile or further from homes in Douglas County. Douglas County had an average of 240 homes in a square mile around a park.

Lancaster County is the second urban county in this study. The metropolitan area within the county is Lincoln. The population estimate for Lancaster County is 274,432 people. Lancaster County is 838.88 square miles. The population density in Lancaster County is 298.3 people per square mile. Lancaster County has a younger population than

other counties observed, and than the state norm with 11.1 % of residents being over the age of 65.

Lancaster county is 91.2 % White, 4.4% Hispanic and 3 % Black. Lancaster County has the second highest observed income levels. Thirty percent of inhabitants earn less than $30,000 per year. Forty-one percent of inhabitants earn between $30,000 and 74,999 each year. Sixteen percent earn more than $100,000. Fifteen point two percent of people in Lancaster County live below the poverty line (census bureau). Seventy- four arrests are made in Lancaster County per thousand people.

Lancaster County ranks first in terms of education. More Lancaster County residents earn high school diplomas, Bachelor's degrees, and Master's degrees or higher here than in any of the other counties being studied. Ninety-three percent of people complete high school, 35% earn a Bachelor's degree, and 12% earn a degree higher than a Bachelor's.

One hundred and nine parks from Lancaster County were counted and measured. The average distance between parks and homes in Lancaster County is .2733 miles. There are .13 parks per square mile in Lancaster County and .0004 parks per person. Lancaster County has the lowest obesity rate, with 24.4 % of residents reported as obese. Lancaster county residents also reported the best health status with 88.7% responding that they are in good to better health and only 11.3% reporting fair to poor health.

Seven percent of parks are between 0 and .049 miles from homes and 29% of parks are between .05 and .09 miles from homes (See Figure 3). Forty-one percent of parks are between .1 and .49 miles from homes, 19.5% are between .5 and .99 miles from

homes and 3.5% of parks are a mile or further from homes in Lancaster County. Lancaster County had an average of 207 homes in a square mile around a park.

Lincoln County has the greatest geographical area of all counties observed with 2563.98 square miles. The population of this county is estimated to be 35,481 people. The population density here is 13.5 people per square mile. North Platte is the county seat and micropolitan area of Lincoln County. This county is designated rural. This is the westernmost and most remote county in the study. Lincoln County has an older population than the rest of the state, with 15.7% of residents reporting as being age 65 or older.

The racial make-up of Lincoln County is least diverse, with 96.8% of residents White, 6.2 % Hispanic and 1% Black. There are 90.2 crime arrests made here per every thousand people. The household income distribution in Lincoln County is similar to that of Adams County. In Lincoln County it is also true that 33% of people earn less than $30,000 each year. Next, 21% earn between $30,000 and $49,000 each year. Then 19% of inhabitants earn between $50,000 and 74,999 each year. The number of people living below the poverty rate in Lincoln County was recorded at 11.2% in 2009.Lincoln County ranks second overall in terms of educational status. Ninety-two percent of residents receive a high school diploma, while 19% earn a Bachelor's degree and 5% earn a Master's degree or higher.

Twenty-two parks were counted and measured in Lincoln County. Lincoln has the most parks per capita. Lincoln County's average distance between parks and homes is by far the greatest here. The average distance between parks and homes in Lincoln County is

1.176 miles. There are .0008 parks per square mile in Lincoln County and .00062 parks per person.

Nine percent of parks are between 0 and .049 miles from homes and 9% of parks are between .05 and .09 miles from homes (See Figure 3). Twenty-seven percent of parks are between .1 and .49 miles from homes, 14% are between .5 and .99 miles from homes and 41% of parks are a mile or further from homes in Lincoln County. Lincoln County had an average of 117 homes in a square mile around a park.

Lincoln County has the second highest obesity rate of all counties observed and is only 1.5 % lower than the highest (Adams) county with a 29% obesity rate. Lincoln County reported the lowest health status with 80.7% of respondents reporting good to better health and 19.3% reporting fair to poor health.

Lincoln County has the fewest number of parks and is the largest in size. However, Lincoln County has the most parks per capita (.00062). Douglas County has the highest density of parks given its size. Adams County is the most obese and Lancaster County is least obese.

On average, parks in Douglas County are the closest to homes while parks in Lincoln County are the furthest from homes. However, although Douglas County also has the greatest number of parks by area and Lincoln has the fewest number of parks by area, there are the most parks per capita in Lincoln County and the fewest parks per capita in Douglas County. Lincoln County reported the worst general health status and the second highest obesity rate. Lancaster County the lowest obesity rate, the best general health status and the second least distance between parks and homes. Adams County reported

the highest obesity rate and the second greatest distance between parks and homes (Figure 4).

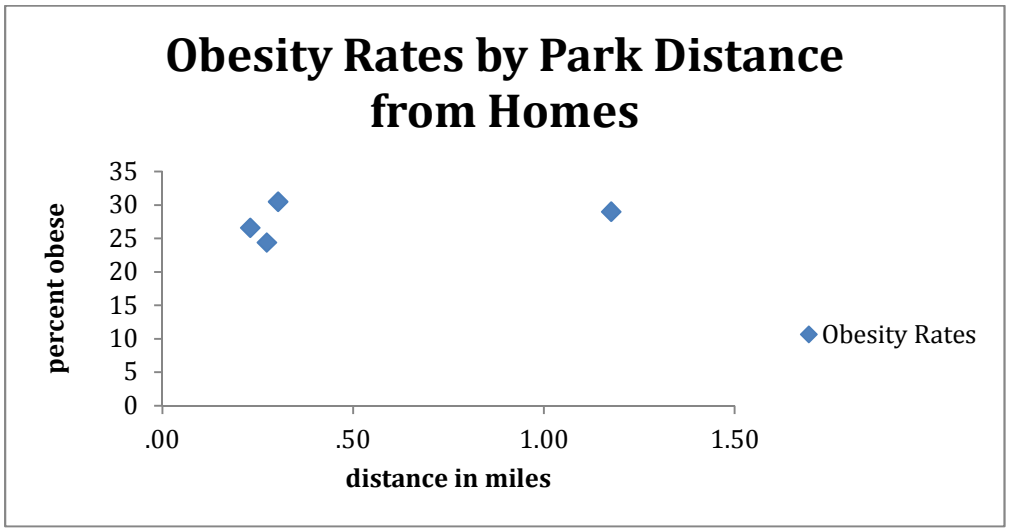


Figure 4: Relationship between Obesity Rates and Distance in Miles Between Parks and Homes

## Discussions and Conclusion

The role community design, measured by distance of homes to parks, plays in obesity rates is a focus of the study. The main association between distance from to parks and obesity rates for counties was explained by county economic resources. Measurements between parks and homes were measured to observe whether the distance between parks and homes is significant to obesity rates in four Nebraska counties. Obesity is a giant issue in the United States right now and understanding if parks play any role in combating this by promoting physical activity is critical as parks provide a number of social services that are often overlooked.

Adams County income figures differ most from Douglas County, the county with the highest income level. This trend supports the presence of rural-urban wealth disparities. Despite these economic differences, Adams and Douglas Counties have very

similar education levels. The education level in Adams County is the lowest of all observed counties. The percentage of people who do not graduate high school is higher than the state norm. Ninety percent of residents have completed high school, while 22% hold a Bachelor's degree and 8% hold a Master's degree or higher. This is in contrast to Lancaster County, with the highest education level of all observed counties, where 35% of people have a Bachelor's degree. This disparity is likely due in part to the fact that the largest university in the state is in Lancaster County. Obesity is also linked with age. As people get older, obesity becomes more likely. Having the state university in Lancaster County not only contributes to a higher educational status for the county, but also a greater proportion of young people than it would have otherwise.

Despite having the fewest parks by area, Lincoln County has the most parks per capita. What stands out most about park information from Lincoln County is that the average distance between parks and homes is by far the greatest here. Parks are on average nearly four times further away in Lincoln County than they are in Adams, Douglas or Lancaster.

There is variation among the counties that is important to consider when interpreting these results. "Park activity participation rates depend upon a variety of demographic, socioeconomic, and regional characteristics" (Bedimo-Rung, 2005, p.162). Even when parks appear to be equally usable, there are often characteristics less apparent than a brightly colored playground that need to be assessed as well. Differences in education, income, age, socioeconomic status, sex, cultural beliefs, and community design are all factors of obesity and differences are present among Adams, Douglas, Lancaster and Lincoln counties.

The results of this study support the CDC's findings of obesity rates following a socioeconomic gradient. Adams and Lincoln counties earn less, have higher obesity rates, report poor to fair health more often and have parks that are typically further from homes than the urban counties of Douglas and Lancaster. They also support the findings of AHRQ that rural residents typically report poor to fair health at higher rates than do urban residents (AHRQ, 2004).

This research supports findings of Kipke et al (2007) that income inequity and obesity are related, as the county with the lowest average income, Adams County, is the county with the highest obesity rate. It also supports the "ecological perspective" concerning the issue of obesity, as it is one that works not only in an individual sphere, but also in a larger societal context. The counties with parks in the closest range of homes had better health outcomes and lower obesity rates. The work of Marcus-Cooper (1999) is also supported here if one extends her concept of gardens to parks as well, the counties (Douglas, Lancaster) with parks most usable in terms of distance from homes reported the better health status and lower obesity rates and she describes physical benefits of exposure to gardens.

Crime strongly limits the usability of parks and increases the risks associated with using parks. Bedimo-Rung et al (2005) found, "Inner-city and poor populations are much less likely to report participation in outdoor recreation activities than other metropolitan and nonmetropolitan residents" (p.162). Physical activity and public social recreation are likely viewed as less important than avoiding robbery or injury. If crime is high in a neighborhood such that people feel it best to avoid park use, there are probably other types of physical activity they are avoiding as well, like walks in the neighborhood. The

mere presence of parks does not guarantee physical activity. Parks must be present in a space that people feel secure and comfortable using and sharing. Without this, a park could be in the next lot but go unused due to associated fears and not increase, but even potentially decrease physical activity within the neighborhood. In this study crime arrest rates were used, but this may not be the best indicator for describing actual levels of crime and violent crime in a county. Crime rates could partially explain why Douglas has a higher obesity rate than Lancaster despite having parks about the same distance from homes.

Sprawl development is also known to make neighborhoods more difficult to walk within and among. Bullard et al., (2000) explain that *sprawl* is random, unplanned growth characterized by inadequate accessibility to essential land uses like housing, jobs, schools, hospitals, transportation". Gandy (2003) refers to parks as "urban lungs" and notes they are an important part of urban planning (p.83). Sprawl is unplanned and typically associated with poor accessibility to "essential land uses" (Bullard, Johnson& Torres, 2000, p.1). This poor accessibility generally makes walking more difficult, which is not beneficial to physical activity levels. Frank et al (2004) study the built environment as a predictor of obesity. They found that mixed –land use is associated with obesity reduction and each hour spent in a car is associated with increased obesity.

Sprawl leads to the abandonment of cities and crumbling of physical infrastructure, including parks. The building of the interstate led to neighborhood fragmentation, aggravation of racial segregation, and displacement of individuals and families. Interruptions in park availability are among the many disruptions brought to communities with the building of the interstate highways during the early 1950s into the

1970s. Protests were raised by people, many of whom had homes and historic or otherwise valuable neighborhood spaces being leveled for the sake of the interstate system.

When interstates were built in the early 1950s, there were large protests. “Century Freeway in Los Angeles would dislocate 3,550 families, 117 businesses, and numerous parks, schools, and churches” (Mohl, 2002, p.35). This was approved in 1968 and so communities were transformed there, as was happening across the nation. These changes were not temporary. Interstates divide cities and towns and make places within walking distance difficult to reach. Issues related to interstates and inner city crime are likely most applicable in Douglas County, the area with the greatest metropolitan area. A limitation of this study is that on the map, a short distance may be given to describe the space between a park and a home, but if an interstate exists in that space, the park is then much more difficult to access, especially for young people, elderly people, and non-drivers.

Usability must take in a variety of social and geographic factors. Since much of this data describes rural areas it is also important to take into account the concentration of homes in the space analyzed. While distance effectively does this to some degree, it is not sensitive to whether or not the house is free standing. A park may appear to be very usable if it is an average short distance, say .04, from homes, but if it is only this near to a few homes, it may not be as usable as the number suggests. East Hershey Wildlife Management Area in Lincoln County exemplifies such a situation.

Despite the fact that distance between homes and parks and home density around parks are measured, the actual number of people who use the parks is a key piece

of information missing from this project. A future project may explore the number of people who use each park and report on the condition and range of facilities in each park.

Future research on this issue should take additional steps to maximize research design. Distance is not always the most accurate measurement to describe how accessible or usable a park is. This is true because although a park is a certain distance from four homes, this does not provide information about those four homes. It does not tell how many people live in those homes, their health status, socioeconomic status, crime involvement, or education. Importantly, especially when considering rural areas, it does not provide information about whether or not those homes are situated within neighborhoods or are free standing. This said, it may appear parks are more accessible simply because they are near a few homes, though they may be outside of a more populated area. The sample taken to describe home density around parks was used to address this issue, but also had limitations of its own. Samples were somewhat skewed due to cloud cover on images from Google Earth that made some areas invisible. Parks with clouds covering neighborhoods were not included in the sample. Apartment complexes were hard to ascribe a value for, typically a value of one was given to each segment of the building, but this is likely inaccurate. Wildlife Management Areas are also typically in remote areas and their presence increased distances from homes and reduced home density around parks. It was important for them to be included though, because they are public wild spaces of great value. They not only teach residents about nature but also work to preserve ecosystems.

Distance and accessibility are not synonymous. While in order to be usable, a park must be close to people, there are other factors that come into play. Crime rates and

interstates or other main roads are a couple examples of limiting factors to seemingly usable parks. This study works from the assumption that parks are beneficial to the community and promote physical exercise. This is not always the case though. Troy and Morgan (2008) inform readers that sometimes parks are seen as a liability rather than an asset to a neighborhood. They write that, "crime is a critical factor conditioning how parks are perceived by residents and valued" (Troy & Morgan, 2008, p.242). It is important to consider crime rates in this study and especially unevenness within counties. This is especially true of Omaha, Douglas County. Omaha is the largest metropolitan area observed in this study and there is likely the most disparity in county crime with Douglas County. Aside from having the greatest number of people in a small area, Omaha also has disproportionate crime rates depending upon where in the city one may find them self. According to SMART data, respondents asked, "How safe do you feel?" (in your community) answered "unsafe" most often if they were from Douglas County.

It is clear that a number of factors influence both individual health status and community design. Economics play a significant part, and this is something that is related to race/ethnicity, urbanity, and education level as well. Parks are a social service.

The county with the fewest number of parks reports the lowest general health status and the second highest obesity rate. The county with the best general health status also has the lowest obesity rate and has second greatest number of parks. The rural counties had higher obesity rates than the urban counties and also lower socioeconomic statuses. The urban county with the perceived lower level of safety and greater economic disparity, Douglas, had a higher obesity rate than the other urban county, Lancaster. The

county with the highest socioeconomic status also had the greatest number of parks, but this does not provide information about how widely those parks are used.

Parks were on average further from homes in rural counties, but the only significant difference in distance was with Lincoln County. Adams County, the most obese, did not show parks were a significantly further distance away than they are in Lancaster County, the least obese. Therefore the expectation that distance from parks would be associated with obesity levels was not supported. It is important to examine what makes a park usable and how limitations to park use can be managed. Parks can promote physical activity and social engagement, but they can also become places of deviant behavior and discourage others from playing there. Usable parks are an important part of active communities. Their benefits should be available to people in rural areas as well as in urban areas. Therefore a more comprehensive measure of "easily useable" parks is needed to more fully assess the idea that space for exercise will help to reduce obesity.

One way that the national obesity problem can be addressed is by assessing the amount of physical activity people incorporate into their daily lives and the public spaces available for this to be performed. As Bell and Montarzino described earlier, "there is a geography to overweight" and it is expansive. Whether this involves major highways, broken playground equipment, few parks, or high crime rates, having parks that are available to residents and they feel comfortable using is one way to change this geography.

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